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Treatment Manual

Certifying Facilities

Certification of Vacuum Fumigation Chambers

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Construction and Performance Standards

Fumigation by vacuum consists of placing the commodity in a gas-tight steel chamber, removing most of the air, and replacing a small portion of it with a gas which is lethal to insects and other pests. Vacuum fumigation provides a more rapid penetration of commodities undergoing treatment than is obtained in atmospheric fumigations. The length of exposure in vacuum fumigation may range from 2 to 4 hours as compared with 12 to 24 hours under atmospheric conditions.

Chamber

Vacuum chambers are usually of welded steel construction. A rectangular chamber may be preferred for more effective use of space. Reinforcement of the chamber body by means of steel ribs, or other supports, is usually required to enable the chamber to withstand the difference in pressures when the vacuum is drawn. Doors may be provided at one or both ends of the chamber. In cylindrical chambers, the doors may be either concave or convex, but in rectangular chambers flat doors are commonly used with suitable reinforcements. The doors may be hinged at the side, or at the top and counterbalanced. Many doors are fitted with special mechanisms for rapid closing. Door gaskets should be durable and at the same time provide gas-tight seal. The efficiency of a chamber depends to a large extent upon the tightness with which the door or doors will seal. All other chamber openings must be equally tight to sustain the prescribed vacuum over a specified period of time.

To permit circulation beneath the load, the chamber must be designed to enable the loading of commodities stacked on pallets, skids, or small trucks. Small chambers which are usually hand loaded should be provided with removable floors.

Vacuum Pump

Each installation required a high quality, high capacity vacuum pump. The vacuum pump should have the capacity to reduce the chamber pressure to 1–2 inches (25–51 mm) of mercury (28–29 inch or 711–737 mm vacuum) in 15 minutes or less.

Fumigant Introduction Systems

The introduction system needed will vary with the type of fumigant in use and the size of the chamber. For small chambers and for introducing fumigants in small quantities, the fumigant may be measured by volume using a graduated dispenser. For larger chambers the gas supply cylinder is placed on a platform scale and the amount of fumigant required is measured by weight.

For most fumigants, a volatilizing unit is required to insure fumigant introduction in a gaseous state. The volatilizer is located outside of the chamber between the gas cylinder or dispenser and the introduction port of the chamber. The volatilizer consists essentially of a metal coil submerged in water which is kept hot enough to vaporize the fumigant. If more than one fumigant will be used in the chamber, a separate volatilizer and gas introduction line should be used for each in order to reduce the possibility of corrosion or formation of precipitates.

Within the chamber the gas introduction system should consist of tubing with multiple graduated openings which will provide uniform distribution of the fumigant throughout the length of the chamber. The tubing shall be installed along the ceiling.

Circulation and Exhaust System

Adequate distribution of the gas is often hindered by the cargo placed in the chamber. To overcome this, vacuum chambers should be equipped with a circulatory system. If fans are employed, the number of fans required would depend upon the chamber design, volume, and loading arrangements. A minimum of two would normally be required for chambers of over 1,000 cu ft capacity (28.31 m³). The fans are to be placed at opposite ends of the chamber facing each other—one high, one low. Additional fans may be required for larger chambers. Their combined capacity should be such that they are capable of moving each minute a volume of air which is equal to approximately one-third the volume of the chamber. Non-sparking, explosion-proof type circulation systems are required with some fumigants.

In most installations, the vacuum pump is used to remove the fumigant following the exposure period. The air-gas mixture is pumped out of the chamber through exhaust ducts or stacks installed

for that purpose. The actual height of these stacks will vary with the location of the chamber, and may be regulated by local safety ordinances.

Accessories

Chambers must be equipped with a vacuum gauge and an instrument for measuring and recording the vacuum drawn and maintained during the exposure period. A temperature instrument must be installed in chambers used for quarantine treatments with long exposure periods. Combination temperature and vacuum recorders are available.

Performance Standards

To qualify for program approval, vacuum chambers must be able to meet or exceed specified vacuum leakage tests. The tests are listed below and determine the classification under which the chamber qualified.

Classification	Initial vacuum equivalent to inches of mercury	Allowable vacuum loss			
		4 hr	6 hr	16 hr	24 hr
Superior	28 1/2	—	1/2"	—	1"
A	28 1/2	1/2"	—	1"	2"
B	28 1/2	1"	—	2 1/2"	3"
C	26	1"	—	2 1/2"	3"

In addition, **ALL** chambers must be capable of meeting the following requirement: A vacuum equivalent to 26 inches (660 mm) of mercury is drawn. The vacuum is then reduced to 5 inches (127 mm) and held for a period of 4 hours. A vacuum of 2 inches (55 mm) or more after 4 hours is considered adequate for this test.

Chambers classified "Superior" or "A" are approved for all vacuum treatments. These chambers are to be tested annually.

Chambers classified "B" are approved for all vacuum schedules up to and including 28-inch (711 mm) sustained vacuum. These chambers are to be tested semiannually.

Approval of a chamber for vacuum fumigation does not include approval for atmospheric (NAP) fumigations. If the vacuum chamber will also be used as a normal atmospheric pressure chamber, then it must also pass a pressure leakage test (see [page-2-5-6](#)).

Actual detailed instructions for constructing a vacuum chamber are not included in this discussion. The information presented is designed to list the component parts that are needed in the chamber and the function of each. Instructions and additional information can be

obtained from the following list of vacuum chamber manufacturers. In furnishing the names of these dealers, no discrimination is intended against any firm whose name may have been omitted. Neither does this program endorse the firms mentioned nor guarantee the reliability of their products. The list is furnished solely for information and convenience.

Partial List of Manufacturers of Vacuum Chambers

Cos-Med Group
(a.k.a. ETO Sterilization, Inc.)
250 Brunswick Avenue
Linden, NJ 07036

Slack Associates, Inc.
540 South Longwood Street
Baltimore, MD 21223

Vacudyne Altair
375 East Joe Orr Road
Chicago Heights, IL. 60411